

## APPLICATION FOR PATENT

**INVENTORS:** DANIEL T. THOMPSON, KEVIN CONN, ERIK ROBERT NIELSEN  
AND BOB HASTINGS

**TITLE:** COMPUTER SERVER HOT PLUG FAN TRAY ASSEMBLY AND  
METHOD OF FAN REMOVAL

## SPECIFICATION

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** None.

### STATEMENTS REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

**[0002]** Not applicable.

### REFERENCE TO A MICROFICHE APPENDIX

**[0003]** Not applicable.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0004]** The present invention relates generally to fans in computers, and more particularly to the installation and removal of fans in computer servers.

#### 2. Description of the Related Art

**[0005]** It is well known in the field of personal computers and related components, such as servers, to include two or more fans for removing the heat from the interior of the components. Oftentimes, two or more fans are installed for purposes of redundancy in the event one fan fails.

**[0006]** One problem that exists is access to the fan in the server or computer when service or replacement is needed. It is known to install fans using a "hot tap plug." A hot tap plug is a blind mating connector wherein the electrical connection is made upon the placement of the fan or other device into its final position.

[0007] Quite often multiple servers are closely stacked in a standing server rack. There is limited space in a rack environment. Existing hot plug fans require removal of the server chassis from the rack environment and/or removal of a top cover of the server chassis to facilitate changing a hot plug fan. This is inconvenient and impractical, in addition to being time consuming. Additionally, the process of changing out a fan typically requires shutting down the device while the servicing is being conducted.

[0008] It is desirable to have an assembly adapted for the easy removal and/or installation of fans in the computer, particularly a server. It is desirable that access to the fans is convenient, practical and requires little time, even in devices which are in a rack environment. Further, it is desirable that servicing of the fans be accomplished without shutting down the server or other such device.

#### BRIEF SUMMARY OF THE INVENTION

[0009] The present invention is an assembly adapted for the easy removal and/or installation of fans in the computer, particularly a server. The present invention provides fan access that is convenient, practical and requires little time, even in devices which are in a rack environment. Further, the present invention allows fan servicing (removal and installation) while the server or other such device continues to run without shutting the device down.

[0010] The present invention is a fan tray assembly which can be pulled out from the rear of the server without having to remove the top cover or pull the server out of the rack. Additionally, the fan tray assembly can be pulled out from the rear of the server while retaining the server's functionality.

[0011] The fan tray assembly includes fan assembly slots, each slot for receiving a fan assembly. In the preferred embodiment of the invention, a hot tap plug is used to provide power to the fan assembly. Preferably, the fan tray assembly includes a hot tap board providing the hot tap plug with the fan assembly when the fan assembly is fully installed in the fan slot. Preferably, a power cable has a first end connected to the hot tap board and a second end connected to a system board, preferably a stationary system board. The power cable is long enough to maintain the supply of power to the hot tap board even when the fan tray assembly is fully extended.

[0012] In the preferred embodiment of the present invention, the fan assemblies are removed and installed from the sides of the fan tray assembly. Additionally, in the preferred embodiment, the placement of the fan tray assembly in the server chassis is generally centrally located with respect to the left and right sides of the server. Further, in the preferred embodiment, the fan assemblies can be removed from the fan tray assembly without extending outwardly beyond the sides of the server chassis. Thus, the required service is accomplished without any encroachment on the space above or below the server, and only access to the rear of the server is required.

[0013] Another feature of the preferred embodiment is that the fan tray assembly includes two pairs of fan assemblies, one pair accessed from the right side and one pair accessed from the left side of the fan tray assembly. The fan tray assembly is designed to allow unrestricted air flow from within the chassis with the fan tray assembly in the installed position. Additionally, the fan tray assembly permits air flow even when in the extended position. Thus, even when the fan tray assembly is in the extended position, the operating fans continue to pull the heated air out of the chassis.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0014] In order to more fully understand the drawings referred to in the detailed description of the invention, a brief description of each drawing is presented, in which:

Figure 1 is a top, rear and left-side perspective view of a chassis having a fan tray assembly according to the present invention;

Figure 2 is a view similar to Figure 1 with the fan tray assembly in an extended position;

Figure 3 is a top, rear and left-side perspective view of a fan tray assembly with two fan assemblies installed in the left-side of the fan tray assembly according to a first embodiment of the present invention:

Figure 4 is a view similar to Figure 3, showing one fan assembly installed and one fan assembly removed from the left-side of the fan tray assembly;

Figure 5 is a left-side elevation view of the fan tray assembly with one fan assembly installed and one fan assembly removed;

Figure 6 is an enlarged partial side elevation view of the fan slots in the fan tray assembly;

Figure 7 is a front elevation view of the fan tray assembly showing a power cable connecting a hot tap board, a fan assembly installed on each side of the hot tap board; and

Figure 8 is a view similar to Figure 7 with one fan assembly partially installed and one fan assembly installed.

## DETAILED DESCRIPTION OF THE INVENTION

**[0015]** The present invention will now be described in greater detail with specific reference to the drawings. The present invention is a fan tray assembly, generally referred to as 20, which is incorporated into a chassis 10 of a computer server or other device as shown in Figs. 1 and 2. As shown in Fig. 2, the fan tray assembly 20 can be pulled out from the rear 12 of the server without removing the top cover or pulling the server out of the rack if in a rack. Additionally, it is to be understood that the fan tray assembly 20 can be pulled out from the rear 12 of the server while retaining the server's functionality.

**[0016]** Referring to Figs. 1-4, the fan tray assembly 20 includes a handle 22 for pulling the fan tray assembly 20 to its extended position from the rear 12 of the chassis 10. The handle 22 is attached to a rear foraminous plate 24. The rear plate 24 includes a plurality of holes or openings 26 to allow air to flow therethrough. As will be explained below, the fan assemblies 50 force hot air out of the rear 12 of the chassis 10 through the rear plate 24. The fan tray assembly 20 also includes a left side 28, right side 30 (Figs. 7 and 8), top 32, and bottom 34 (Figs. 7 and 8). Preferably, the fan tray assembly 20 does not include a front panel so that air flow is not obstructed. As shown in Figs. 7 and 8, the bottom 34 preferably is foraminous, perforated, or slotted to allow air flow and cool a board (not shown) located beneath the bottom 34. Although not shown, the sides 28 and 30 could also include openings for air flow if necessary or desirable.

**[0017]** Referring to Fig. 2, the fan tray assembly 20 slides in and out of the rear 12 of the chassis 10. Although not shown in the drawings, it is to be understood that various types of slide mechanisms or techniques can be used to permit the sliding action of fan tray assembly 20 relative to the chassis 10.

[0018] As shown in Figs. 1 and 2, in the preferred embodiment of the invention the fan tray assembly 20 includes a latch mechanism 36 accessible at the rear plate 24 for permitting the release and extension of the fan tray assembly 20 from the chassis 10. It is to be understood that various types of latch mechanisms 36 would be readily apparent to persons of ordinary skill in the art.

[0019] Referring to Figs. 3-6, the fan tray assembly 20 includes a plurality of fan assembly slots 38. Each slot 38 receives a fan assembly 50. The number of fan assemblies 50 will vary depending upon the specific application and desired redundancy. Typically, a server will include four fan assemblies 50. Although not clearly shown, it is to be understood that in the attached drawings, the illustrated fan tray assembly 20 includes a pair of fan assemblies 50 on the left side 28 and a pair of fan assemblies 50' (Figs. 7 and 8) on the right side 30. For purposes of simplification, it is to be understood that discussion of fan assemblies 50 applies equally to the fan assemblies 50'. As shown in Figs. 4 and 8, the fan assembly 50 slides into the slot 38. It is to be understood that the fan assembly 50 preferably includes a catch for securing the fan assembly 50 in the slot 38 upon being fully inserted. Suitable catches are well known to those skilled in the art.

[0020] In the preferred embodiment of the invention, a hot tap plug 42 is used to provide power to the fan assembly 50. Referring to Figs. 5, 6 and 8, the fan tray assembly 20 preferably includes a hot tap board 40 providing the hot tap plug 42 with the fan assembly 20 when the fan assembly 20 is fully inserted in the fan slot 38. Preferably, a power cable 44 has a first end 44a connected to the hot tap board 40 and a second end (not shown) connected to a system board (not shown), preferably a stationary system board. The power cable 44 has a length sufficient to maintain the supply of power to the hot tap board 40 even when the fan tray assembly 20 is fully extended as shown in Fig. 2.

[0021] In the preferred embodiment of the present invention, the fan assemblies 50 are removed and installed from the sides 28, 30 of the fan tray assembly 20 as shown in Figs. 2, 4, and 8. Additionally, in the preferred embodiment, the placement of the fan tray assembly 20 in the server chassis 10 is generally centrally located with respect to the left and right sides, 28 and 30 respectively, of the server as shown in Figs. 1 and 2. Further, in the preferred embodiment, the fan assemblies 50 can be removed from the fan tray assembly 20 without extending outwardly beyond the sides 28 and 30 of the server chassis 10. Thus, the

required service is accomplished without any encroachment on the space above or below the server, and only access to the rear of the server is required.

[0022] As discussed above with respect to the illustrated preferred embodiment, the fan tray assembly 20 includes one pair of fan assemblies 50' accessed from the right side 30 and one pair of fan assemblies 50 accessed from the left side 28 of the fan tray assembly 20. The fan tray assembly 20 is designed to allow unrestricted air flow from within the chassis 10 with the fan tray assembly 20 in its installed position. Additionally, the fan tray assembly 20 permits air flow even when in its extended position as shown in Fig. 2. Since the server does not need to be shut down to remove or replace any inoperative fan assembly 50, even when the fan tray assembly 20 is in the extended position, the operating fans 50, 50' continue to pull heated air out of the chassis 10 and cool the server while the inoperative fan assembly is being replaced.

[0023] It is to be understood that the present invention is particularly well suited for use in servers mounted in a rack. The present invention allows one to quickly and easily change out a fan assembly 50 in a rack-mounted server from the rear of the server. Although the invention has been described with respect to the fan tray assembly 20 extending from the rear 12 of the chassis 10, it is to be understood that the fan tray assembly 20 could also be incorporated in the front of the chassis, if desired. Preferably, the fan assemblies 50 mount from the sides 28 and 30 to enable access while the server is still in the rack.

[0024] The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the details of the illustrated apparatus and construction and method of operation may be made without departing from the spirit of the invention.